Multiple Choice:

4) A
5) C
8) B
10) C
15) C
16) B
18) A
22) C
23) D
24) D

27) C
35) B
36) D
37) C
38) C

4.5- Frequency Tables

	Drink (D)	Don't Drink (DD)	
Smoke (Sm)	315	165	480
Don't smoke (DS)	585	135	720
	900	300	1200

Find the probability that:

a) the student smokes $P(Sm) = \frac{480}{1200} =$

b) the student smokes given that he is a drinker $P(Sm \mid D) = \frac{315}{900}$

c) the student drinks and smokes $P(D \cap Sm) = \frac{315}{1200}$

d) the student smokes or he doesn't drink

$$P(Sm \cup DD) = \frac{(315+165+135)}{1200}$$

2) a) P(N) = 1800/2000 = 90%

b) P(H|L) = 10/100 = 10%

c) P(N U R) = (190+1710+90)/2000 = 99.5%

3) a) P(<35) = 42968/151616 = 0.283

b) P(C) = 30781/151616 = 0.203

c) P(<35 n C) = 10174/151616 = 0.067

d) P(C|<35) = 10174/42968 = 0.237

e) P(<35 U C) = (32794+10174+20607)/151616 = 0.419

AP Stat
4.5 notes

BAYES' RULE (aka Multistage Problems)

- Let A = 1st event
- Let B = 2nd event

We know that $P(B|A)$ ~~?~~ $\neq$ $P(A|B)$

So how can we find $P(A|B)$? In other words, how can we find the probability that the first event (A) happened given that we know the second event (B) happened?

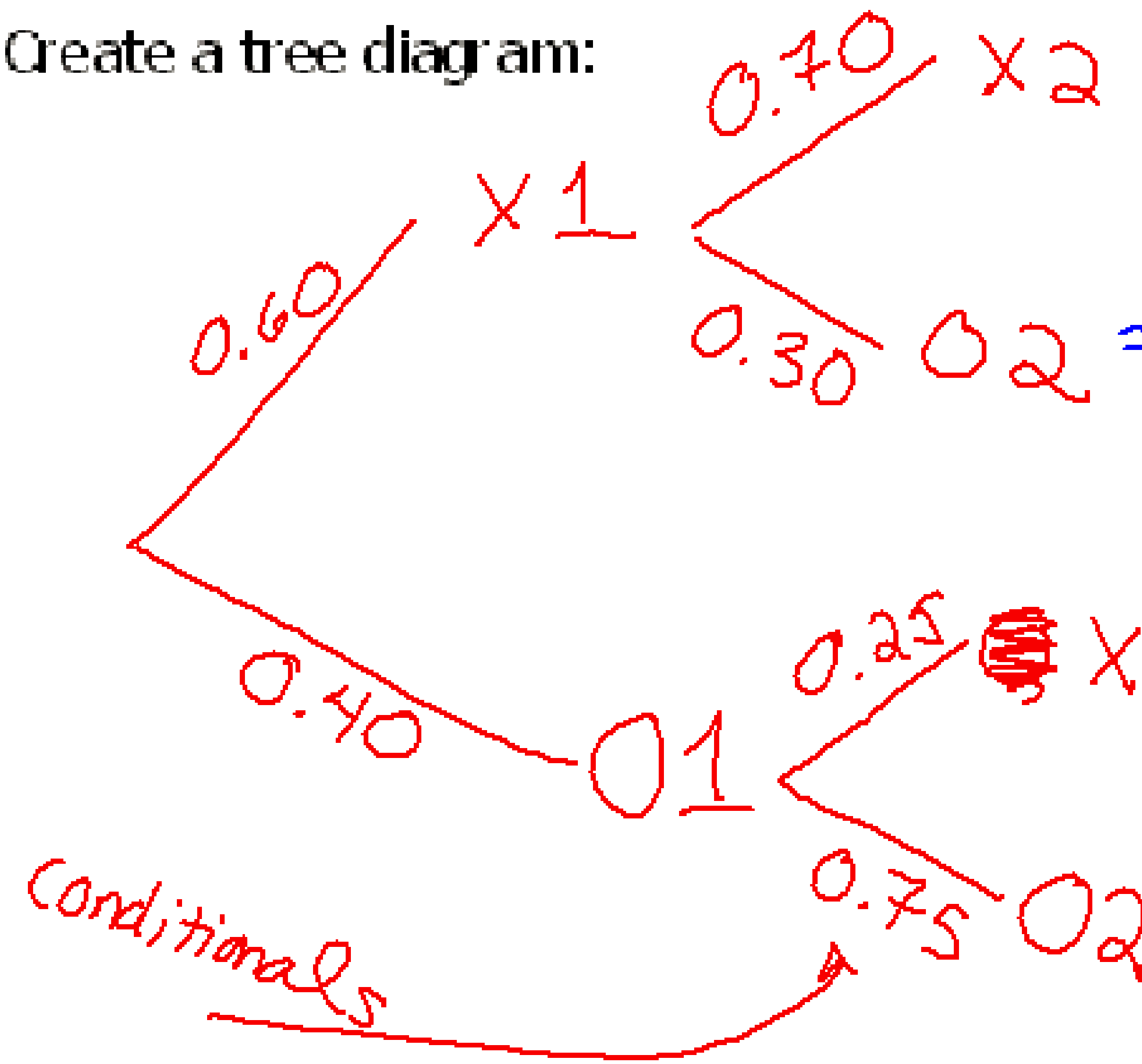
Bayes' Rule: (page 356)

$P(A|B)$ = ______________________________

However, this rule is long, complicated, and a very difficult formula.
So instead, we use **TREE DIAGRAMS**

Think of this example:
A basketball player shoots 2 free throws. The following probabilities apply:
Prob. of making the 1st = 0.6 $P(X1) = 0.60$
Prob. of making the 2nd **given that** you make the 1st = 0.70 $P(X2 \mid X1) = 0.70$
Prob. of making the 2nd **given that** you missed the 1st = 0.25 $P(X2 \mid O1) = 0.25$

Create a tree diagram:



$X2 = P(X1 \cap X2) = 0.42$

$O2 = P(X1 \cap O2) = 0.18$

$X2 = P(O1 \cap X2) = 0.10$

$O2 = P(O1 \cap O2) = 0.30$

$\overline{}$ 1

$$P(O1 \mid X2) = \frac{0.10}{0.52}$$

So now lets answer some questions:

1. What is the probability of missing the 1st free throw? $P(O1) = 0.40$

2. What is probability of making the first free throw **and** making the second free throw?

   $P(X1 \cap X2) = 0.42$

3. What is the probability of making the second **given that** you missed the first?

   $P(X2|O1) = 0.25$

4. What is the probability of missing the second **given that** you made the first?

   $P(O2|X1) = 0.30$

Now lets try some harder ones: (use the probability rules!!)

1. What is the probability of making the second free throw?

$$P(X2) = 0.42 + 0.10 = 0.52$$

2. What is the probability of missing the second free throw?

$$P(O2) = 0.30 + 0.18 = 0.48$$

So lets say you went to the bathroom and didn't see the first free throw......

3. What is the probability you made the first given that you make the second?

$$P(X1|X2) = 0.42/0.52 = 0.808$$

4. What's the probability you missed the first given that you make the second?

$$P(O1|X2) = 0.1/0.52 = 0.192$$

Example #1

- A cancer clinic gives free cancer test *(hypothetically)*
- It is known that 2% of the people that come into the clinic have cancer *(hypothetically)*
- It is known the test comes up positive in 98% of people with cancer
- It is known the test comes up positive in 3% of people without cancer

$P(C) = 0.02$

$P(+|C) = 0.98$

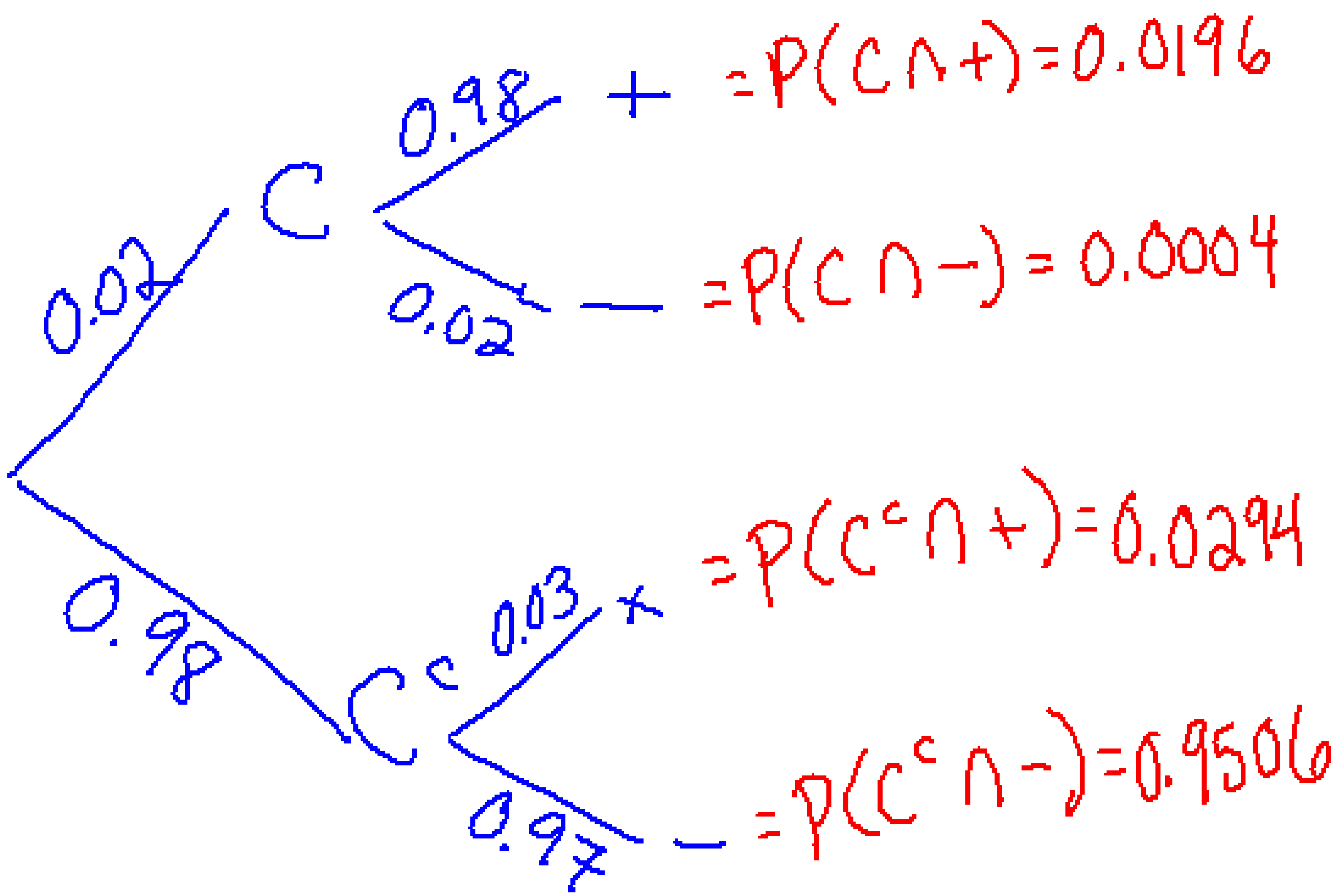
$P(+|C^c) = 0.03$

Create the tree diagram:

1st event = cancer

2nd event = result of test

$\boxed{8)\ P(C|-) = 0.000421}$



1) $P(+|C) = 0.98$

2) $P(+|C^c) = 0.03$

3) $P(-|C) = 0.02$

4) $P(-|C^c) = 0.97$

5) $P(+) = 0.049$

$P(-) = 0.951$

6) $P(C|+) = \frac{0.0196}{0.049}$

7) $P(C^c|+) = \frac{0.0294}{0.049}$

Example #2:

- There are 2 textbook making companies, A and B
- It is known that 1% of company A's books are defective
- It is known that 2% of company B's books are defective
- CB South gets 38% of its books from company A and the rest from company B

Make the tree diagram below, then answer the questions: